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DIVERSIFICATION OF OYSTER MUSHROOM (Pleurotus Ostreatus) MEDIA FROM AGRICULTURAL WASTE MATERIALS

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Abstract

Utilization of agricultural wastes needs to be researched and developed so there is a diversification media of oyster mushroom nursery. Waste must contain lignin and protein. Lamtoro seed and cotton seeds can replace corn. Tofu and soy replace bran. The research objective is to get the oyster mushroom nursery media from agricultural and agro-industrial waste. The treatments tested are main media: corn, lamtoro seed, cotton seed and Factor II: Starter bran, tofu and soy skin. Complete randomized design was repeated 3 times. Parameter observations include water content, pH, organic C, total N and C / N ratio, rate of growth, weight of mycelium and production of fresh oyster mushrooms of various seeds cultured in media tested. The results is 3-5% moisture content, pH 6.5-7.2, 42-46.4% organic C value, the value of 0.73-1.35% total N and C / N ratio of 33.87-58.90. Media derived from the lamtoro seeds provide the lowest growth. Mycelium weight reaching 23-25 grams, and speed of weight gain 1.70-2.66 g / day. 800 - 1100gr per bag log mushroom production. Conclusion is oyster mushrooms can be grown on media from agricultural and agroindustry waste and the ability to produce fresh oyster mushrooms are not significantly different from controls.

Keywords: diversification, media breeding, oyster mushrooms

BACKGROUND

Agricultural waste is widely available in Indonesia. Waste does not mean it is useless but can still be reused either directly or through the process of recycling or waste treatment. Utilization of waste is still very lacking and farmers tend to lack understanding that there are some waste that can be utilized. Therefore, there needs to be innovation and socialization to the community about increasing the added value of waste. Agricultural waste is relatively natural both in the form of residual crops and residual materials agroindustry. The untapped part of the plant can be said to be waste. Agricultural waste containing lignin and protein can be used as a medium for oyster mushroom spawning so that the community is not dependent on only one kind of raw material for spawning media.

Currently oyster mushrooms attracted many people and farmers seize the opportunity so today many farmers cultivate oyster mushrooms. To reduce the cost of oyster mushroom production, it needs innovation on the raw material of the spawning media and also the mushroom growing media of oyster mushroom itself (bag log). Utilization of agricultural waste as raw material of spawning media need to be researched and developed and exploited to have diversification of raw material for oyster mushroom media. The raw materials of the spawn media used by farmers are corn and bran seeds. Agricultural waste that allows as a raw material for oyster mushroom media is waste containing lignin and protein. For that we need to test the potential of spawn media derived from agricultural waste. The selected raw materials are lamtoro seeds and kapok seeds as a substitute for maize. The tofu and soybean skin which is a waste of tempeh production is used as a starter to replace bran.

The purpose of this research is to get the media of oyster mushroom spawn from agricultural waste and agroindustry. This research produces a variety of spawn media from waste materials and oyster mushroom spawn.

METHODS

Treatment tested Factor I: Main Media i.e. corn seed, lamtoro seed and kapok seeds. Factor II: Starter is bran, tofu waste and soybean seed skin. The design used Completely Randomized Design (CRD) was repeated 3 times.

1. Observation parameters include: media condition (water content , pH, C organic, N total and C/N ratio)
2. The speed of mycelium growth and the rate of weight gain of mycelium on the spawn medium The speed of mycelium growth and the rate of weight gain of the mycelium vertically can be calculated by the formula
   a. Speed of mycelia growth vertically.
   Measures of mycelia growth vertically rate are performed on spawn in small bottles. The bottles are scaled on the upper boundary of the substrate to the bottom of the bottle at 1 cm intervals. Marking of scale lines ranging from 1 cm to 25 cm scale lines (as high as the bottle used)
   Measurement of the growth rate of mycelia (cm / day) is carried out every mycelia growth reaches the interval line. Formula:
   $$MGSV = \frac{\text{size scale to line} - \text{i (cm)}}{\begin{array}{c}\text{(The time taken by the mycelium}\\ \text{to meet the size scale i cm (day))}\end{array}}$$
   Description:
   MGSV = Mycelia Growth Speed Vertically
   b. The weight of miselia (spawn) at the end of growth, by calculating the difference of bottle weight when the inoculation would be carried and the bottle at the end of growth
3. Fresh oyster mushroom production from various cultured spawn on the tested medium

RESULT AND DISCUSSION

Media lamtoro + corn, lamtoro + tofu waste and lamtoro + soybean skin has the lowest water content and C / N ratio. The tested media is alkaline and has an organic C value that is not significantly different as well as for the total N value. Spawns of oyster mushrooms can grow on all media tested.

The lowest growth rate of mycelium occurs in spawn grown on either lamtoro media combined with bran, tofu and soybean. The highest value is achieved by the spawns that grow on the medium of corn both combined with bran, tofu waste and soybean skin. Growth of spawns (mycelium) reaches 100% at week four to week six. While the lowest weight gain of the lowest mycelium occurs in seedlings that grow on the media lamtoro both combined with bran, tofu and soybean skin.

Fresh oyster mushroom production can be harvested after 39 days planted in bag-log. Seeds produced on various waste media are inoculated in bag9log. Oyster mushroom production resulting from bag-log was not significantly different between treatments. Fresh mushroom production reaches 800 - 1100gr per bag-log within 30-45 days.

Spawning media from agricultural waste and agroindustry waste conditions are eligible for mycelium growth. The mycelium can grow well in neutral to alkaline conditions. The water content of the media supports the creation of moisture for the growth of mycelium up to 100%. The C / N ratio shows the availability or absence of nutrients for mycelium. The higher the value then indicates the ingredients are already degraded and ready as a mycelium food as well as the total N content indicates the availability of the required protein of mycelium growth. Furthermore, it was revealed by Hamdiyati (2012) which states that the weathering process occurs simplification of complex compounds such as glucose in the form of polysaccharides converted into disaccharides and monosaccharaides. With weathering for several days ease the mushroom to absorb nutrients for growth and development to reach optimal levels. Furthermore Seswati (2013) explains that the acidity of the media needs to be set between pH 6-7 by using chalk (calcium carbonate).

One of the factors supporting the success of spawning is media. Media from agricultural waste and agro industry can grow oyster mushroom spawns. This can happen because the waste used contains lignin and protein needed for the growth of mycelium oyster mushroom spawn (Ira Wijaya, 2011). In the process of making a main culture, besides wood powder in general, the medium grows of mycelia also can be selected from grain media rather than wood media, this is due to the high level of success, cheap, and easy to manufacture (Fithrawan Satriyanto, 2010). The main advantage of grains is the high availability of nutrients for mushroom growth. The disadvantage is that high levels of these nutrients also result in higher risk of contamination than other ingredients. Commonly used grains are corn rice and soybean flour. (Khan et al., 2012).

The tofu waste and soybean skin has a good ability to support the growth of oyster mushroom spawns. The nutrient content found in the dregs know protein 26.6 gram and 11.0% rough protein soybean, 61.0% cell wall, 16.0% hemicellulose, 42.0% cellulose, 2.0% lignin (Nursiam I, 2012)

Seeds of lamtoro and cotton can also support growth of mushroom spawn. Nutritional content of lamtoro seeds is 10.6 grams of protein, 26.2 grams of carbohydrates. Cotton seeds contain 32.7% crude protein and 16.7% crude fiber. Furthermore Cotton seeds also contain 3-8% cotton in the form of cellulose that is easily digested. Nutrient content of crude protein 4.1% and crude fiber 47.8%. (Godam 2012).

The growth of mycelia in the stages of the main culture usually requires more nutrient available media so that it can be obtained by mushroom spawn that grow rapidly and immediately can be inoculated into bag log. Mushroom spawn in bag log usually use the media because the oyster mushroom is a kind of wood mushroom. The wood powder is of various kinds. Sawdust nyatoh (Palaquium spp) produce an average biomass of white oyster mushroom (P. ostreatus) is higher (19.962 g) than sawdust meranti (Shorea spp) that only 18.064 g and powdered ironwood (Euzidroxylon zwageri) 15.778 gr. But there are still many sawmills that have not been studied. Therefore, it is necessary to do a study that aims to determine the effect of the growing medium some powder waste of sawn timber against the growth of oyster mushroom (P. ostreatus). (Fauzia, Yusran, Irmasari, 2014). Furthermore, Kasmawati, Periadnadi, Nurmiati (2013) and Pradita Kirana (2012) says that for the modification of mushroom media grow, it can be done by reducing the portion of corn, and can be coupled with banana leaves, kiambang or others seeds that contain lots of protein (soybean, peanut, oil cakes, tofu) and NPK that has been melted from liquid lamtoro, thitonia and other materials rich in nutrients.

The productions of fresh oyster mushrooms do not showed differences between treatments although spawn conditions differ. This proves that the spawns produced from waste media are still able to grow in bag log and produce well. Superior mushroom seeds will produce a high quality fruit body and allow it to adapt to a wider environment. The characteristics of good spawns is having a Biological Efficiency Ratio (BER) more than 75%, white and has grown full and evenly in the nursery media, and there is no sign of contamination when nursery was held. Furthermore Widiwurjani (2015) and Berlin Sani (2016) explained that in addition to spawn, the factors affecting the growth rate of mycelium are largely influenced by moisture and temperature. The humidity required for the incubation phase is 60-70% and the air temperature is between 22-28°C.

Table 1. Result of Water Content Analysis, pH, C Organic, Total N and C/N Ratio on various spawning medium

Spawning Medium	Water Content (%)	pH	C organic (%)	N total (%)	C/N Ratio
T1L1 (corn + bran)	5	7	46.4	0.87	53.33
T1L2 (corn + tofu waste)	4.5	7.2	46.3	0.95	48.74
T1 L3 (corn + soybean skin)	4.5	7.1	46	0.92	50
T2L1 (lamtoro + bran)	3	6.5	44	1.2	36.67
T2L2 (lamtoro + tofu waste)	3.5	7	46.3	1.35	34.3
T2L3 (lamtoro + soybean skin)	3.5	6.7	42	1,24	33.87
T3L1 (cotton + bran)	4	7	43	0.73	58.9
T3L2 (cotton + tofu waste)	4.5	7.2	46.3	0.8	57.88
T3L3 (cotton + soybean skin)	4.5	6.6	44	0.84	52.38

Table 2. Average Vertical Growth Rate of Mycelium on Each Observation

Observation	Average Vertical Growth Rate of Mycelium (cm / day)							Average
	2 cm	4 cm	6 cm	8 cm	10 cm	12 cm	14 cm	
T1L1 (corn + bran)	0.50a	0.29a	0.33ab	0.36ab	0.40b	0.44b	0.47b	0.40ab
T1L2 (corn + tofu waste)	0.67b	0.31a	0.30a	0.38ab	0.42b	0.43b	0.44b	0.42b
T1 L3 (corn + soybean skin)	0.50a	0.40b	0.35ab	0.40b	0.40b	0.41b	0.44b	0.41ab
T2L1 (lamtoro + bran)	0.50a	0.33ab	0.30a	0.29a	0.27ab	0.30a	0.31a	0.33a
T2L2 (lamtoro + tofu waste)	0.67b	0.31a	0.30a	0.30ab	0.29a	0.32a	0.35a	0.36ab
T2L3 (lamtoro + soybean skin)	0.50a	0.33ab	0.30a	0.30ab	0.31a	0.32a	0.31a	0.34ab
T3L1	0.67b	0.40b	0.40b	0.33ab	0.34ab	0.36b	0.38ab	0.41ab

(cotton + bran)								
T3L2 (cotton + tofu waste)	0.50a	0.40b	0.35ab	0.33ab	0.32ab	0.33ab	0.35a	0.37ab
T3L3 (cotton + soybean skin)	0.50a	0.40b	0.33ab	0.32ab	0.31a	0.46b	0.35a	0.38ab
LSD	0.08	0.08	0.08	0.1	0.08	0.08	0.09	0.08

Note: Figures accompanied by the same letter in the same column mean no difference in the 5% LSD test

Table 3. Average Weight of Mycelium, Growing Time, the Rate of Weight Gain of Mycelium and the Production of Fresh Oyster Mushrooms

Observation	Weight of Mycelium (gr)	Growing Time (day)	Rate of Weight Gain (gr/day)	Production of Fresh Mushrooms (gr)
T1L1 (corn + bran)	75	30	2.5	1100. 54 c
T1L2 (corn + tofu waste)	85	32	2.66	1080.22 c
T1 L3 (corn + soybean skin)	75	32	2.34	1098.33 c
T2L1 (lamtoro + bran)	77	45	1.71	835.44 a
T2L2 (lamtoro + tofu waste)	69	40	1.73	800.67 a
T2L3 (lamtoro + soybean skin)	68	40	1.7	815.87a
T3L1 (cotton + bran)	69	37	1.86	1100.79 c
T3L2 (cotton + tofu waste)	83	40	2.08	988.43 b
T3L3 (cotton + soybean skin)	90	45	2	1067.31c
LSD	NR	NR	NR	40.45

Spawn of oyster mushroom can be grown on nursery media derived from agricultural wastes (lamtoro seeds and cotton seeds) and agroindustry waste (soybean skin as a waste of tempeh and tofu / tofu waste). The resulting of fresh oyster mushrooms is not significantly different from the control (mixture of bran and corn seeds) except for the media derived from lamtoro seed both combined with bran, tofu and soybean skin.

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